

P a t e n t   C l a i m s

1. A method for determining the limpness of sheet material (BN), in particular bank notes (BN), comprising the steps:
  - irradiating the sheet material (BN) with sound waves,
  - measuring the sound waves emanating from the irradiated sheet material (BN),
  - determining the limpness of the sheet material (BN) on the basis of the measured sound waves,characterized in that  
  
both sound waves those reflected by the sheet material (BN) and those transmitted are measured, and a mathematical ratio of the reflected and the transmitted sound waves is formed, in order to determine the limpness.
2. The method according to claim 1, characterized in that the measuring of the reflected and the transmitted sound waves is taken from a common place (6) on the sheet material (BN).
3. The method according to any of the above claims, characterized in that a measure for another property of the sheet material than the limpness, such as e.g. the nominal value of the sheet material, the weight per unit area and/ or the degree of soiling of the sheet material (BN), is determined and is taken into consideration when determining the limpness.
4. The method according to any of the above claims, characterized in that a measure for the sound waves irradiating the sheet material (BN) is measured and taken into consideration when forming the ratio for determining the limpness.
5. The method according to any of the above claims, characterized in that the frequency spectrum of the sound waves is measured and taken into consideration when determining the limpness.

6. The method according to any of the above claims, characterized in that the transit time of sound waves in the sheet material (BN) is measured and taken into consideration when determining the limpness.
7. The method according to any of the above claims, characterized in that for determining the transit time of sound waves in the sheet material (BN) a measuring, in particular an optical measuring, of the deflection (A) of the sheet material (BN) is carried out.
8. The method according to any of the above claims, characterized in that defective areas of the sheet material are determined and these areas are not taken into consideration when determining the limpness.
9. The method according to any of the above claims, characterized in that the excitation of the sheet material and/ or the measuring of the sound waves emanating from the sheet material is carried out in a contacting fashion.
10. An apparatus (1, 1') for determining the limpness of sheet material (BN), in particular bank notes (BN), having
  - a source of sound (2, 2') for irradiating the sheet material (BN) with sound waves,
  - a measuring device (3, 4) for measuring the sound waves, which emanate from the irradiated sheet material (BN),
  - an evaluation unit (5) for determining the limpness of the sheet material (BN) on the basis of the sound waves captured by the measuring device (3, 4),

characterized in that

the measuring device (3, 4) has both a reflection sensor (3) for measuring the sound waves reflected by the sheet material (BN), and a transmission sensor (4) for measuring the sound waves transmitted through the sheet material (BN), and the evaluation unit (5) is adapted to form a

mathematical ratio of the reflected and transmitted sound waves measured, in order to determine the limpness.

11. The apparatus according to claim 10, characterized in that the evaluation unit (5) is adapted to form a mathematical ratio of the reflected and the transmitted sound waves emanating from a common place (6, 6') of the sheet material (BN), in order to determine the limpness.
12. The apparatus according to at least one of the claims 10 or 11, characterized in that the measuring device (3, 4) has a broadband microphone (3, 4), in order to determine the frequency spectrum of the captured sound waves.
13. The apparatus according to at least one of the claims 10 to 12, characterized in that the measuring device (3, 4, 7) has a unit (7) for determining the transit time of sound waves in the sheet material (BN).
14. The apparatus according to at least one of the claims 10 to 13, characterized in that the measuring device (3, 4, 7) has a unit (7) for determining another property of the sheet material than the limpness, such as e.g. the nominal value of the sheet material, the weight per unit area and/ or the degree of soiling of the sheet material (BN).
15. The apparatus according to at least one of the claims 10 to 14, characterized in that the source of sound (2, 2') and/or the measuring device (3, 4) is in contact with the sheet material (BN) to be measured.